



## PCT

## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference F18761 LVDW		<b>FOR FURTHER ACTION</b>		See Form PCT/PEA/416
International application No. PCT/IB2005/050448		International filing date (day/month/year) 03.02.2005		Priority date (day/month/year) 05.02.2004
International Patent Classification (IPC) or national classification and IPO INV. C10G2/00 C07C1/20 C07C41/01 C07C41/09				
Applicant SASOL TECHNOLOGY (PROPRIETARY) LIMITED				
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 19 sheets, as follows:</p> <p><input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 807 of the Administrative Instructions).</p> <p><input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>				
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the report</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>				
Date of submission of the demand  02.12.2005		Date of completion of this report  14.07.2006		
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523658 epmu d Fax: +49 89 2399 - 4465		Authorized officer Seufert, G Telephone No. +49 89 2399-6630 		

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.  
PCT/B2005/050448

AP20 Rec'd PCT/PTO 04 AUG 2005

## Box No. 1 Basis of the report

1. With regard to the language, this report is based on
  - ☒ the international application in the language in which it was filed
  - ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
    - ☐ international search (under Rules 12.3(a) and 23.1(b))
    - ☐ publication of the international application (under Rule 12.4(a))
    - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))
2. With regard to the elements\* of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

### Description, Pages

1-16 received on 07.12.2005 with letter of 02.12.2005

### Claims, Numbers

1-10 received on 07.12.2005 with letter of 02.12.2005

### Drawings, Sheets

1/1 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
    - ☐ the description, pages
    - ☐ the claims, Nos.
    - ☐ the drawings, sheets/figs
    - ☐ the sequence listing (*specify*):
    - ☐ any table(s) related to sequence listing (*specify*):
  4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
    - ☐ the description, pages
    - ☐ the claims, Nos.
    - ☐ the drawings, sheets/figs
    - ☐ the sequence listing (*specify*):
    - ☐ any table(s) related to sequence listing (*specify*):

\* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT  
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**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

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**1. Statement**

Novelty (N)	Yes: Claims	1-10
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1-10
Industrial applicability (IA)	Yes: Claims	1-10
	No: Claims	

**2. Citations and explanations (Rule 70.7):**

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
REPORT ON PATENTABILITY  
(SEPARATE SHEET)**

101388473  
PCT/IB2005/050448  
International application No.

PCT/IB2005/050448

Reference is made to the following documents:

- D1 GB-A-2 092 172
- D2 GB-A-2 097 382
- D3 Ullmann's Encyclopedia of Industrial Chemistry, 6th. ed." 2003, pages 651-668
- D4 WO 02/26676 A
- D5 GB-A-2 253 623
- D6 GB-A-2 391 008

**V. Reasoned statement with regard to novelty, inventive step or industrial applicability**

**Novelty**

The present application refers to a process for synthesising hydrocarbons, which process includes feeding a gaseous feedstock comprising hydrogen, carbon monoxide and carbon dioxide, into a dimethyl ether (DME) synthesis stage, the gaseous feed having a syngas number (SN) between 1.8 and 2.2 where  $SN = [H_2]/[CO_2]/[CO] + [CO_2]$  and where  $[H_2]$ ,  $[CO]$  and  $[CO_2]$  are the molar proportion in the gaseous feedstock; in the DME synthesis stage, converting a portion of the gaseous feedstock into a DME product and gaseous products; separating the DME product from unreacted gaseous reactants and the gaseous products to obtain a tail gas comprising hydrogen, carbon monoxide and carbon dioxide; recycling a portion of the tail gas from the DME synthesis stage to the DME synthesis stage, a ratio of the tail gas recycle to gaseous feedstock being between 0:1 and 2:1; feeding the tail gas into a two-phase high temperature catalytic Fischer-Tropsch (FT) hydrocarbon synthesis stage; and allowing the hydrogen, carbon monoxide and carbon dioxide at least partially to react catalytically in the Fischer-Tropsch hydrocarbon synthesis stage to form hydrocarbons (claim 1), the hydrocarbons formed in the Fischer-Tropsch hydrocarbon synthesis stage thus being gaseous at the operating pressure and temperature of the Fischer-Tropsch hydrocarbon synthesis stage.

Document D1 discloses a process for the preparation of dimethyl ether from a

gaseous feedstock comprising hydrogen, carbon monoxide and carbon dioxide in a first stage. DME is separated and the gaseous product of the first stage comprising hydrogen and carbon monoxide is fed to a second Fischer-Tropsch reaction to produce hydrocarbons, see D1, page 2, lines 31-34, example 8, claim 1. The presently claimed process is distinguished from D1 in the specific syngas number of the gaseous feedstock and in that the Fischer-Tropsch hydrocarbon synthesis stage is a high temperature two-phase synthesis stage. Thus, the subject-matter of claim 1 as well as the dependent claims 2-10 is considered to meet the requirement of Art. 33(2) PCT.

It should be noted that the recycling of a portion of the tail gas from the DME synthesis stage into the synthesis stage is considered to be an optional feature, because the ratio of the tail gas recycle to the gaseous feedstock can be 0:1. With the tail gas recycle being zero no recycling takes place.

### **Inventive step**

The subject-matter of the claims is not considered as involving an inventive step for the following reasons.

As mentioned above the presently claimed process is distinguished from D1 in the specific syngas number of the gaseous feedstock and in that the Fischer-Tropsch hydrocarbon synthesis stage is a high temperature two-phase synthesis stage. The recycling of a portion of the tail gas can be absent.

The requirement of a syngas number between 1.8 and 2.2 is already known as advantageous in the production of methanol, see D4, page 3, lines 21-23, page 7, line 30 - page 8, line 19, which is the first compound to be produced in the DME-synthesis. Keeping the syngas number in the aforementioned range is therefore considered to be obvious for the skilled person. Also well known in the art is the high temperature two phase reaction in the Fischer-Tropsch synthesis, see D3, page 651 - 653. The skilled person is aware of the fact that in this high temperature reaction carbon dioxide is reactive.

The separation of Fischer-Tropsch products in various streams useful for further

processing is also known, see for example D3, page 659, chap. 2.2.4, table 13 or page 660, fig. 6. Furthermore, D3 already states that naphtha is an ideal feedstock for cracking to olefin (see D3, page 651, right column, lines 25-26).

The subject-matter of claims is therefore not considered to meet the requirement of Art. 33(3) PCT.

The applicant's argument submitted with the amended claims have been considered, however, the aforementioned opinion has been maintained for the following reasons: The applicant argues that neither D1 nor D2 refer to the presently claimed syngas number. This is correct, but the skilled person is also aware of the fact that the production of methanol can be improved by using a feedstock with the required syngas number. Furthermore, according to the applicant the process of the invention, contrary to D1 or D2, uses a limited recycle of the tail gas from the DME synthesis stage. However, the presently claimed process does not necessarily include this recycling, i.e. the ratio of the tail gas recycle to the gaseous feedstock being between 0:1. Additionally, the applicant argues that the syngas number of the DME tail gas is almost identical to the syngas number of the gas introduced into the DME synthesis stage, which is still well suited for use in a high temperature Fischer-Tropsch hydrocarbon synthesis stage and does not require adjustment of the tail gas before being fed into the FT-synthesis. However, this feature is not present in the claims. Apparently, to achieve this, the conversion in the DME synthesis stage has to be controlled (applicant's letter page 5, lines 13-18), which, taking the example into account, can be done with a recycle ratio of 1.1:1.

The allegedly achieved better conversion compared to D1 (applicant's letter from 07.12.05) cannot be used to support an inventive step, because the example in D1 and the present application are distinguished also by other parameters (pressure, temperature, catalysts) and therefore cannot be directly compared to demonstrate that the presently claimed features are the cause for this alleged improvement.

### **Industrial applicability**

There are no objections against the industrial applicability of claims 1-10.

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(SEPARATE SHEET)**

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**Further remarks:**

It should be noted that for the present opinion the term "includes" has been interpreted as "comprising".

The applicant has amended claim 4 (original claim 7) by introducing the pressure to overcome a clarity objection, i.e. missing feature(s) necessary to achieve the desired result. Taking the comparative example 1 and example 2 according to the invention into account, it seems to be obvious that the pressure is not relevant for achieving this result, see example 1, page 14, lines 24-27 and example 2, page 15, lines 8-12.